1. Exploration of GHz-THz spectroscopy for characterization of transformations in organic materials

**Summary:** The THz spectral range (0.1 – 10 THz) of the electromagnetic spectrum is most recently explored for sensing applications, as it seems ideally suited to probe collective intermolecular secondary interactions (van der Waals, dipole-dipole, dipole-induced dipole, ...) in a large variety of materials. In case of (thermal) phase transformations (e.g. crystallization, melting, vitrification, densification, gelation, chemical reaction,...), the intermolecular secondary interactions in the material will change. Therefore, this novel THz sensor technology has a high potential as an emerging physical/chemical analytical tool for the real-time monitoring of phase transformations in materials. It will be explored and compared to classical thermal analysis techniques in well-chosen case studies of polymer systems (food, biomedical and energy applications, bulk samples and thin layers/coatings, ...).

Project in collaboration with research group of Prof. J. Stiens (department Electronics and Informatics; ETRO-VUB).

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2. 3D-printing of self-healing materials for robotics applications

**Summary:** The aim of this project is to evaluate the feasibility of the 3D-printing of self-healing polymer networks for application in soft robotics. Over the past years, a series of self-healing reversible covalent networks was developed in our lab and successfully used for creating a self-healing mechanical fuse and a self-healing pneumatic actuator. 3D-printing of components would be a major step forward in the design and production of components. This work will involve some polymer synthesis, characterization by thermal analysis, the processing into SH actuator parts and their evaluation.

Project in collaboration with Prof. Bram Vanderborght of the Robotics & Multibody Mechanics Research Group of VUB.

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3. Crystallization of vegetal fats

**Summary:** For fats and fat replacements, the texture is strongly influenced by the processing conditions, like cooling rate or shear. Depending on the conditions, different polymorphs and crystal morphologies may be induced. The aim of this project is to study the link between the shear-dependent crystallization and the changes in rheology and to investigate the influence of the composition on the structure-processing-property relationships.

Project in collaboration with Cargill, Vilvoorde.

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